

**List of Claims:**

**Claim 1 (Currently Amended):** A method of reducing a quantization distortion created by quantization of a speech signal by a sample-by-sample quantizer, the speech signal including a plurality of frames, the method comprising:

detecting that one frame of the plurality of frames was previously quantized;

determining a quantization level for each of a plurality of samples of the one frame;

estimating an expected quantization distortion for each of the plurality of samples based on the quantization level of each of the plurality of samples;

summing up the expected quantized distortion of each of the plurality of samples to generate a summed quantization distortion; and

removing the summed quantization distortion from the one frame.

**Claim 2 (Currently Amended):** The method of claim 1, wherein the determining includes using quantization indices to determine the quantization ~~levels~~ level for each of a plurality of samples.

**Claim 3 (Currently Amended):** The method of claim 2, wherein the quantization indices are obtained by analyzing the one frame to determine a type of the sample-by-sample quantizer and requantizing the one frame.

**Claim 4 (Cancelled)**

**Claim 5 (Currently Amended):** The method of claim 1 where ~~the reduction of~~ reducing the quantization distortion is part of ~~the~~ a pre-processing of the speech signal prior to encoding.

**Claim 6 (Currently Amended):** The method of claim 1 where ~~the reduction of~~ reducing the quantization distortion is part of ~~the~~ a post-processing of the speech signal following decoding.

**Claim 7 (Previously Presented):** The method of claim 1, wherein the removing is performed in the frequency domain.

**Claim 8 (Previously Presented):** The method of claim 1, wherein the removing is performed in the time domain.

**Claim 9 (Currently Amended):** A method of reducing quantization distortion created by a sample-by-sample quantizer, the method comprising:

- (a) determining quantization levels of a frame of a previously quantized signal;
- (b) estimating an expected quantization distortion for each of the quantization levels;
- (c) summing the expected quantization distortion for each of the quantization levels for the frame of the previously quantized signal; and
- (d) removing the summed expected quantization distortion from the frame.

**Claim 10 (Currently Amended):** The method of claim 8 where (b) further comprises determining ~~the~~ a distribution of the previously quantized signal ~~quantized to each of~~ within the quantization levels and storing the expected quantization distortion in a distortion table.

**Claim 11 (Currently Amended):** The method of claim 8 where (c) further comprises assuming a magnitude spectrum of the expected quantization distortion is flat and assuming a phase spectrum of the expected quantization distortion is the same as the previously quantized signal.

**Claim 12 (Previously Presented):** The method of claim 9 further comprising initially determining if a signal has been subject to quantization by the sample-by-sample quantizer.

**Claim 13 (Currently Amended):** The method of claim 11 further comprising executing ~~the remainder of the method~~ after the initially determining if the signal has been subject to quantization by the sample-by-sample quantizer.

**Claim 14 (Previously Presented):** The method of claim 12 further comprising determining a type of sample-by-sample quantization.

**Claim 15 (Currently Amended):** The method of claim 8 where (a) further comprises quantizing ~~the~~ a signal with a sample-by-sample quantizer prior to determining the quantization levels.

**Claim 16 (Original):** The method of claim 9 where (d) further comprises removing the expected quantization distortion in the frequency domain.

**Claim 17 (Original):** The method of claim 9 where (d) further comprises removing the expected quantization distortion in the time domain.

**Claim 18 (Currently Amended):** A method of estimating quantization distortion for a frame of a signal that has been quantized using sample-by-sample quantization, the method comprising:

- (a) determining ~~the~~ a distribution of the signal within a plurality of quantization levels;
- (b) estimating an expected quantization distortion for each of the quantization levels based on the distribution;
- (c) determining an expected quantization distortion for the frame as a function of the expected quantization distortion of each of the quantization levels;

(d) determining a phase spectrum of the expected quantization distortion of the frame.

**Claim 19 (Previously Presented):** The method of claim 18 further comprising (e) determining a spectral shape of the expected quantization distortion of the frame as a function of an error criterion used during the sample-by-sample quantization.

**Claim 20 (Previously Presented):** The method of claim 19 further comprising (f) approximating the spectral shape of the expected quantization distortion of the frame as flat.

**Claim 21 (Cancelled)**

**Claim 22 (Previously Presented):** The method of claim 18 further comprising (e) assuming that the phase spectrum of the expected quantization distortion of the frame is equal to the phase spectrum of the frame.

**Claim 23 (Original):** The method of claim 18 where (b) further comprises determining an upper boundary and a lower boundary for each of the quantization levels.

**Claim 24 (Currently Amended):** A method of reducing the quantization distortion created during quantization of a signal by a sample-by-sample quantizer, where a frame of the signal comprises a plurality of samples that are quantized to one of a plurality of quantization levels by the sample-by-sample quantizer, the method comprising:

- (a) receiving the frame of the signal;
- (b) identifying ~~the~~ a quantization level of each of the samples;
- (c) obtaining ~~the~~ an expected quantization distortion of each of the samples;
- (d) summing the expected quantization distortion of each of the samples ~~quantization levels of the frame~~; and
- (e) removing the sum of the expected quantization distortion from the frame.

**Claim 25 (Previously Presented):** The method of claim 24 further comprising initially determining if the frame was previously quantized.

**Claim 26 (Original):** The method of claim 24 where (a) comprises receiving the signal with a base station.

**Claim 27 (Original):** The method of claim 24 where (a) comprises receiving the signal with a mobile communication device.

**Claim 28 (Original):** The method of claim 24 where (a) comprises receiving the signal with a public switched telephone network.

**Claim 29 (Original):** The method of claim 24 where (a) comprises receiving the signal from a communication medium.

**Claim 30 (Original):** The method of claim 24 where (a) comprises receiving the signal with a packet-based network.

**Claim 31 (Original):** The method of claim 24 where (c) further comprises determining a distribution of the samples within the quantization levels.

**Claim 32 (Original):** The method of claim 24 where (d) further comprises determining a magnitude spectrum of the expected quantization distortion, and determining a phase spectrum of the expected quantization distortion.

**Claim 33 (Original):** The method of claim 24 where the quantization levels are obtained from the signal without additional processing.

**Claim 34 (Original):** The method of claim 24 where (b) further comprises re-quantizing the signal.

**Claim 35 (Original):** The method of claim 24 where (c) further comprises retrieving the expected quantization distortion from a distortion table.

**Claim 36(Original):** The method of claim 24 where (e) further comprises removing the expected quantization distortion in the frequency domain.

**Claim 37 (Original):** The method of claim 24 where (e) further comprises removing the expected quantization distortion in the time domain.

**Claim 38 (Currently Amended):** A distortion removal system for a frame of a signal that includes quantization distortion resulting from the frame being previously quantized to a plurality of quantization levels by a sample-by-sample quantizer, the distortion removal system comprising:

a distortion identification module operable to identify an expected quantization distortion for each of the quantization levels in the frame;

a summer module operable to sum the expected quantization distortion of each of the quantization levels in the frame; and

a distortion removal module operable to remove the summed expected quantization distortion.

**Claim 39 (Original):** The distortion removal system of claim 38 further comprising an initial processing module operable to determine and provide the quantization levels to the distortion identification module.

**Claim 40 (Original):** The distortion removal system of claim 39 where the initial processing module further comprises a sensing module and a quantization module.

**Claim 41 (Original):** The distortion removal system of claim 38 where the distortion identification module comprises a distortion determination module and a distortion table.

**Claim 42 (Original):** The distortion removal system of claim 38 where the distortion removal system is operable to pre-process the signal prior to encoding.

**Claim 43 (Original):** The distortion removal system of claim 38 where the distortion removal system is operable to post-process the signal following decoding.

**Claim 44 (Original):** The distortion removal system of claim 38 where the distortion removal module is operable to remove the expected quantization distortion in the frequency domain.

**Claim 45 (Original):** The distortion removal system of claim 38 where the distortion removal module is operable to remove the expected quantization distortion in the time domain.